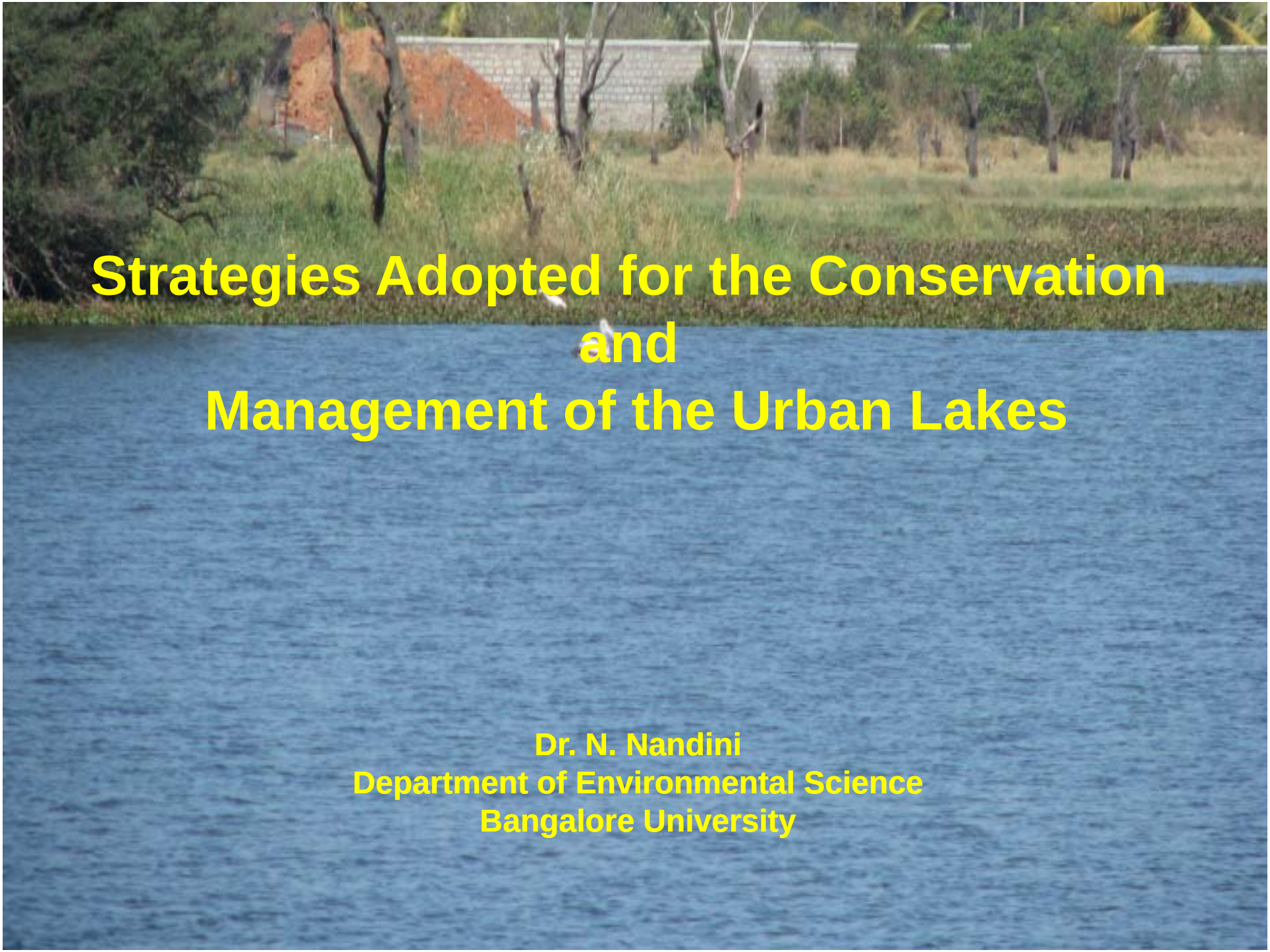

Strategies Adopted for the Conservation and Management of the Urban Lakes

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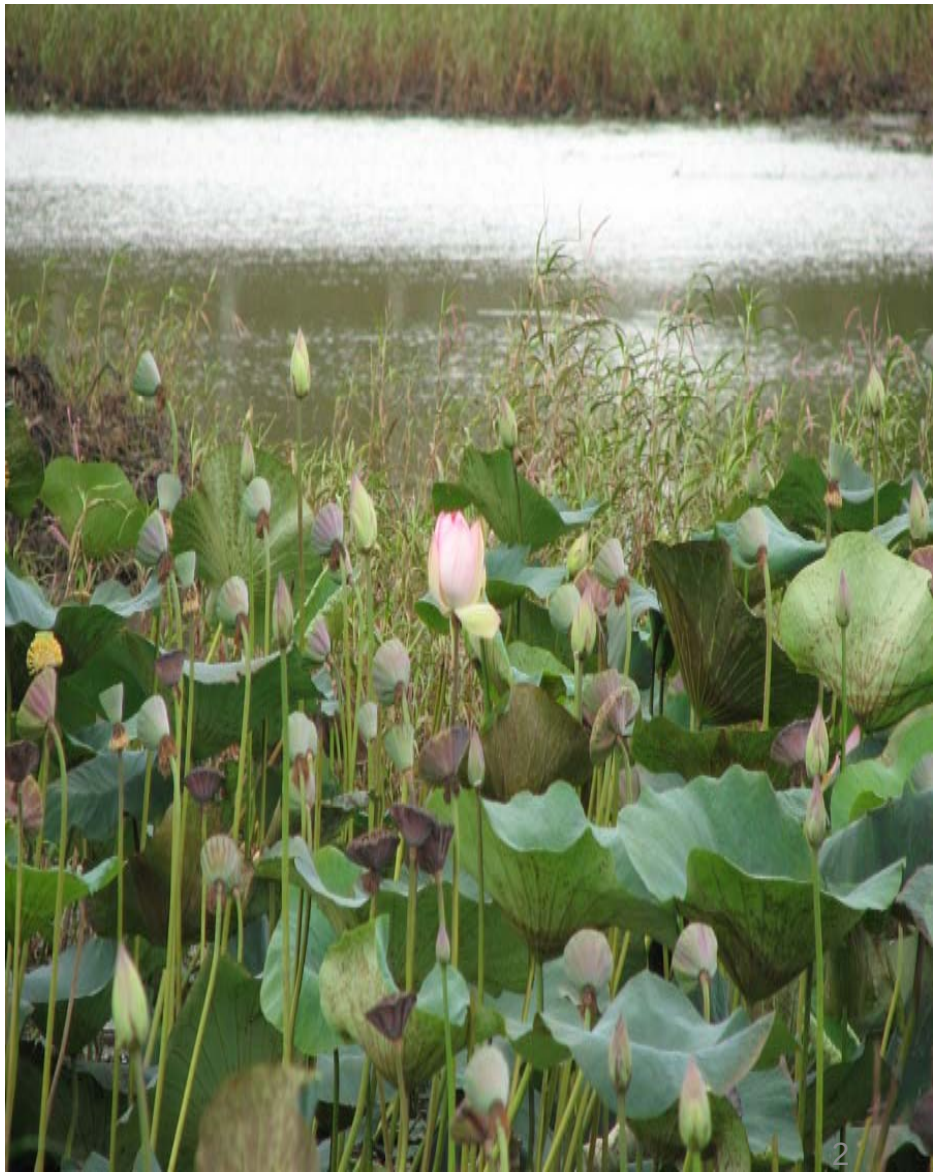
1.Introduction

- Wetland ecosystems account for about 6% of the global land area and are among the most threatened of all ecosystems.

- Wetlands are key habitats connected physically and socially with processes over a much wider territory.

- Wetland destruction by human intervention commenced long ago and has accelerated in recent times.
- Wetlands are valuable assets to the society and one should remember that draining out or dewatering a lake unscientifically will lead to irreversible damage.
- There has been a growing interest from the general community, local elements in taking part towards saving our lakes.



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- Lakes are randomly disturbed in the name of ecological engineering such as dredging, desiltation, embankment, re-shaping, diversions etc,.
- All these activities are undertaken in the name of lake restoration activities.

- But does anyone ask about how the lakes biodiversity components will survive all these engineering activities? What about the **water quality** and its **biochemical constituents?** The **flora** and **fauna** of the lakes? The natural sanctuary for **birds** and other **wild life** communities.

- Even if we build so called bird islands in the middle of the lake ; what environmental guarantee do we have for the survival of **migratory birds**, when we have already flushed out the entire **food web** through our lake engineering activities?

Konnasundra

Kotnur

- Many wetlands degraded-unsustainable levels of the municipal and industrial waste water discharge, solid waste dumps, encroachment and reclamation, ground water extraction, and unsustainable fishing activities.
- These factors are already known and can be accounted in daily management issues. But **to what level and at what cost?**

Dumping sites in Somasundrapalya lake

2. Causes and impacts of Wetland degradation in Bangalore.

- sewage pollution
- Quarrying within wetland basins
- Sand mining of lake beds and basins
- Deforestation of wetland flora
- Overfishing of indigenous fish species
- Ground water mining in catchments
- Diversion of water channels for irrigation.
- Brick making factories along the banks.
- Overgrazing by domestic herds.
- Illegal encroachment wetlands basins.
- Hostile Recreational Activities on Wetlands.

Quarrying around Venkatespura Lake

Continue..

- **Agricultural zones** in urban areas particularly around lakes. Like Belandure , Varthur, Byaramangala, jakkure and Mallathalli chemicals that are classified as dirty dozen internationaly such as DDT and aldrin to name a few, are used extensively.
- Other chemicals labelled “Hazardous” by the world health association are in common use, many considerd potentially carcinogic by the american EPA and the european union classification.

Mallathalli

- Permethrin has been defined by US EPA as possible human carcinogienic, malathion is on the WHO watch list. Butachlor and captan are all listed as potentially carcinogenic.
- **Agro-chemical pollution** coming from agriculture, horticulture, and other cropping schemes- pesticides, metal-complexed inorganic fertilizers, volatile organic substances (VOS), poly-aromatic hydro-carbons (PAH) can persist in lake sediments for a long time. The danger is when the surface water volume filters through this sediment load towards the underground aquifers.

Raw sewage (Kotnur)

Grazing inside Kotnur Lake

Irresponsible Development Works

A broken STP plant (Narsipura Lake)

Threat of industrial pollution Kamagondanahalli Lake

Deforestation of the entire catchment area in Venkatespura

The Outlet is Heavily Polluted (Byaramangala Lake)

3.The main factors influencing human-induced pollution in the watershed zone include:

- Excess sediment/silt inputs caused by **destructive form of land use** and other land clearance activities paving way mainly for housing, quarrying and farming. **Sediments destroy wetlands** and block penetration of light into the water column thus killing aquatic life-forms.

- They can also act as **carrier of nutrients** and other pollutants that favor one array of species against the other causing a **disruption of species composition** in that local ecosystem.

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- **Excessive water withdrawals** or diversions affecting the natural lake inflow volume as against the outflow capacity.
- **Increasing layouts** in the basin zones cause an uncontrolled mechanical piercing of ground water reservoirs with large scale extraction of ground water for domestic and industrial purposes.
- Moreover, the **unused or abandoned tube-wells** are converted as **“flushing-points”** to rid off unwanted domestic and industrial discharges.

- **Sewage and Industrial pollution** caused by direct discharge of domestic and industrial waste from surrounding industries and households. This can add toxic chemicals, BOD, and effluents to a lake basin.

Cont…

•**Water extraction through irrigation purposes**, causing pollution on crops and also drying of lake aquifers. This is evident in lakes such as Chikkabanavara, Madhavara, T.G. Halli, Byramangala, etc.

•**Severe encroachment** of land immediately on the banks of the lakes. Severe cases in the region have been documented in Madhavara, Malathalli, Ullal, Kengeri Uppanagara, Komaghatta, Ramasandra

4.Aquatic Biodiversity and the New Ecological Threat

- If there are **guidelines** governing the environmental safety and protection of water resources from unwanted human interjections that could prove fatal for the aquatic life and destroy the aquatic biodiversity, then we are certain that no one is seriously following them.

- However, the inland fresh water fish catch in Bangalore Urban was recorded at almost 3,000 Metric Tonnes by 2005-06. This was an increase from 2,400 Metric Tonnes in the year 2004-05.

- The on-site analysis of the water samples of **Malathalli** lake showed that the pH of the lake ranged between 8.88 – 9.27, an increase from the mean 8.46 in the previous monitoring **program** of 2006-2007. Electrical Conductivity (EC) ranged 1437 micro mhos/cm – 1478 micro- mhos/cm; up from the mean 1285.0 micro mhos/cm in 2006-07 analysis program. Total Dissolved Solids (TDS) ranged 782 mg/L – 811 mg/L, up from the mean 594 mg/L of the previous months.

Biodiversity in and around Mallathalli

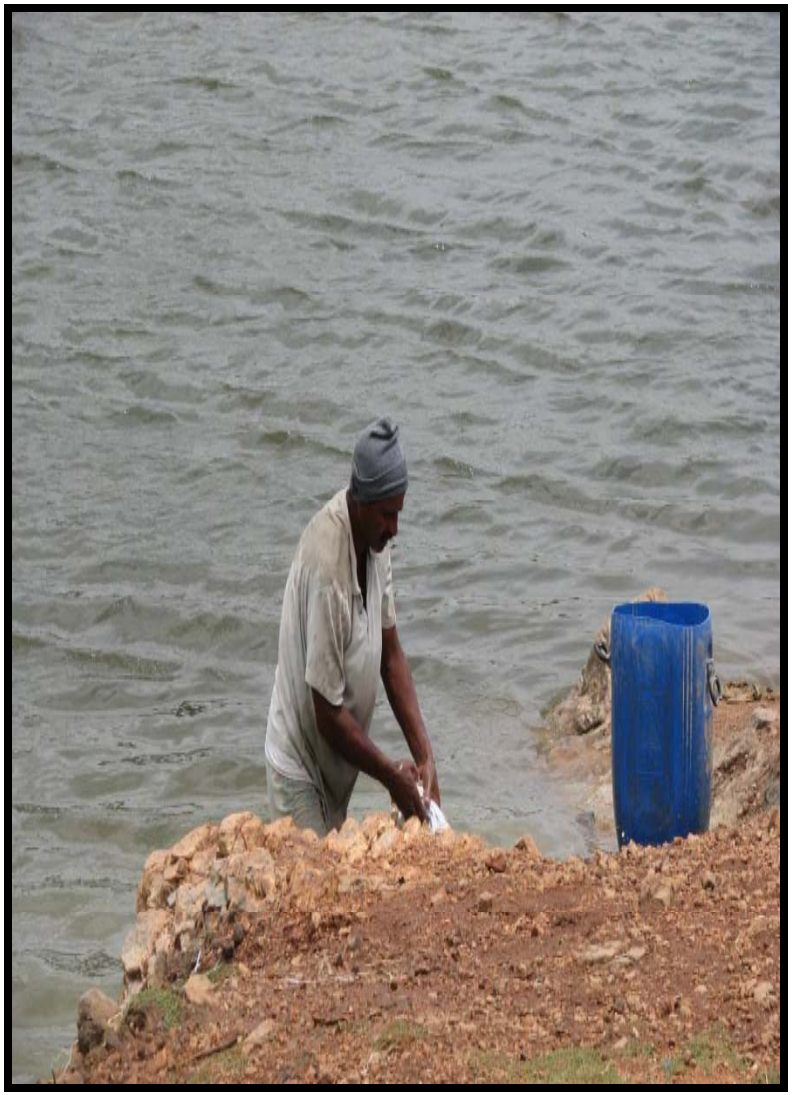
Open solid waste dumps

Car Washing in a lake is now a fashion

Use of dangerous biochem products in fishing

An algal “oil spill” by unsustainable breed

Chemical pollution in outlet (Byramangala)

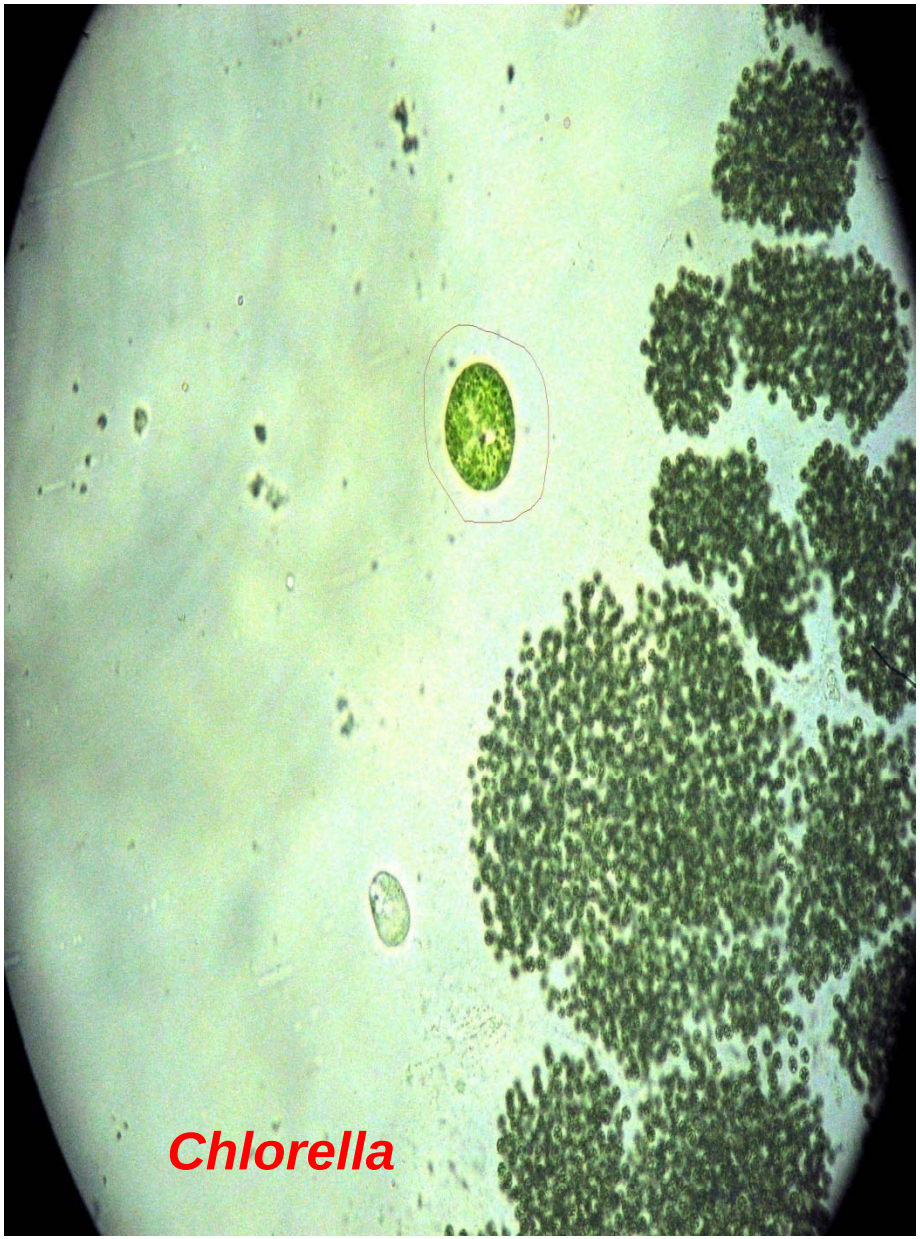


Washing off consutruction waste and paints

- Water Temperature Range at this time: 29.4C – 30.4C in several points of the shoreline water that was tested. This was certainly due to one fact only: Algal blooms in a massively polluted water body that may have been caused by the use of a biotech food.

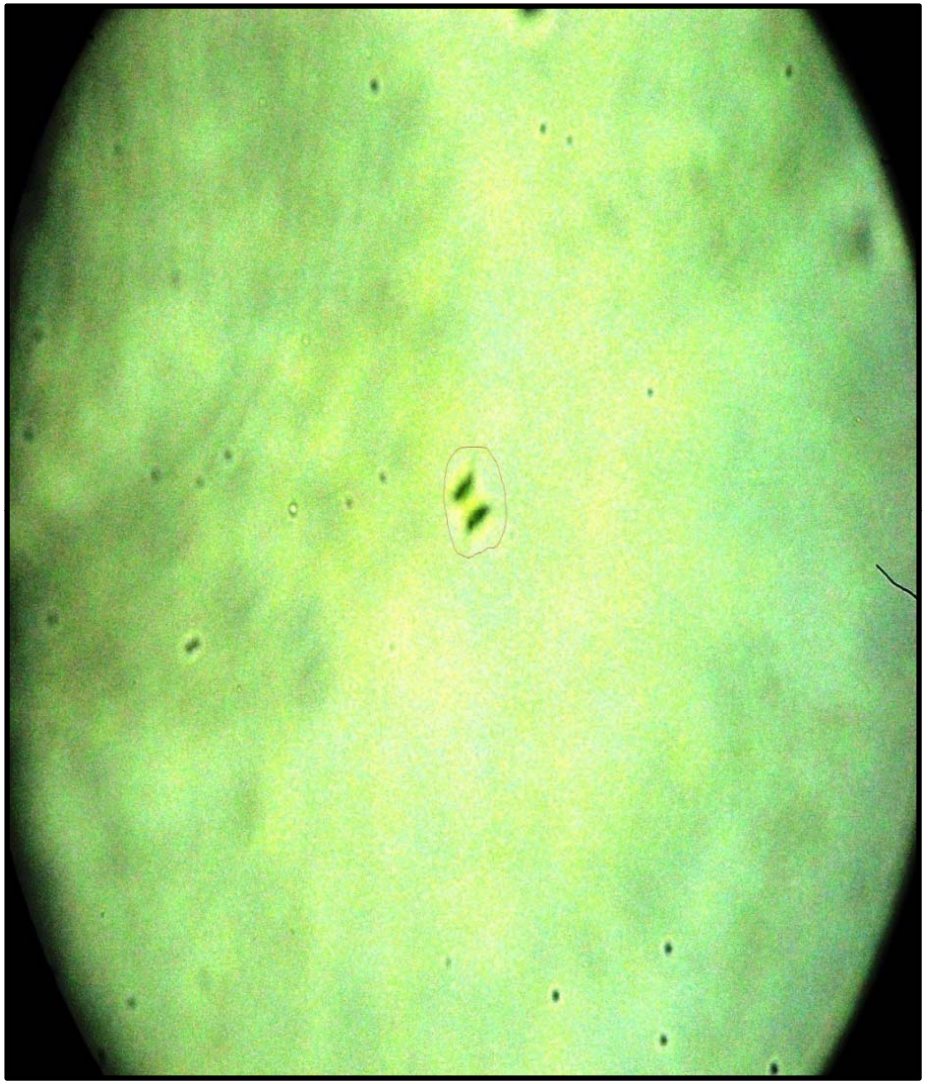
- ***Chlorella, Ulothrix, Gelocapsa, Ankistrodesmus, Desmids, Scenedesmus, Gloeotrichia, Gomphosphaeria, Clorococcums***, and other Diatoms. ***Chlorella*** is a good indicator of **Phosphates and Nitrates pollution** levels of a water body. According to the United States Foods and Drugs Enforcement Agency, **Gleocapsa** - if ingested by humans can cause **stomach pains and vomiting**. ***Ankistrodesmus*** have a high tolerance to pollution and can even **resist Copper Sulphate solutions** meant for de-weeding purposes of the lake.

- ***Scenedesmus*** is a common **bio-indicator** of physical changes in the lake ecosystem. This organism is also critical in detecting presence of **excessive nutrients and toxins** in the water body resulting from anthropogenic inputs into aquatic ecosystem. Diatoms are also known as Boom and Bust Algae while **Cynobacteria** such as ***gloeotrichia*** and ***gomphosphaeris*** are characteristic of a **potential cyanotoxins** affecting fish and other aquatic animals.

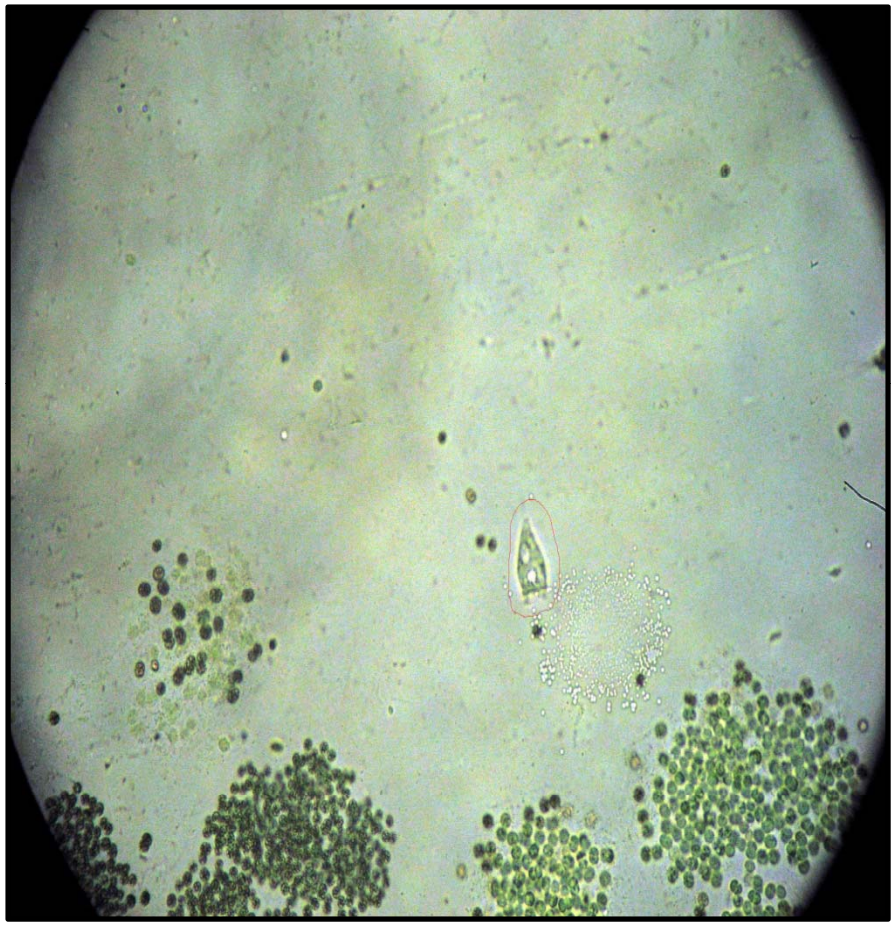

Chlorella


Oikomonus

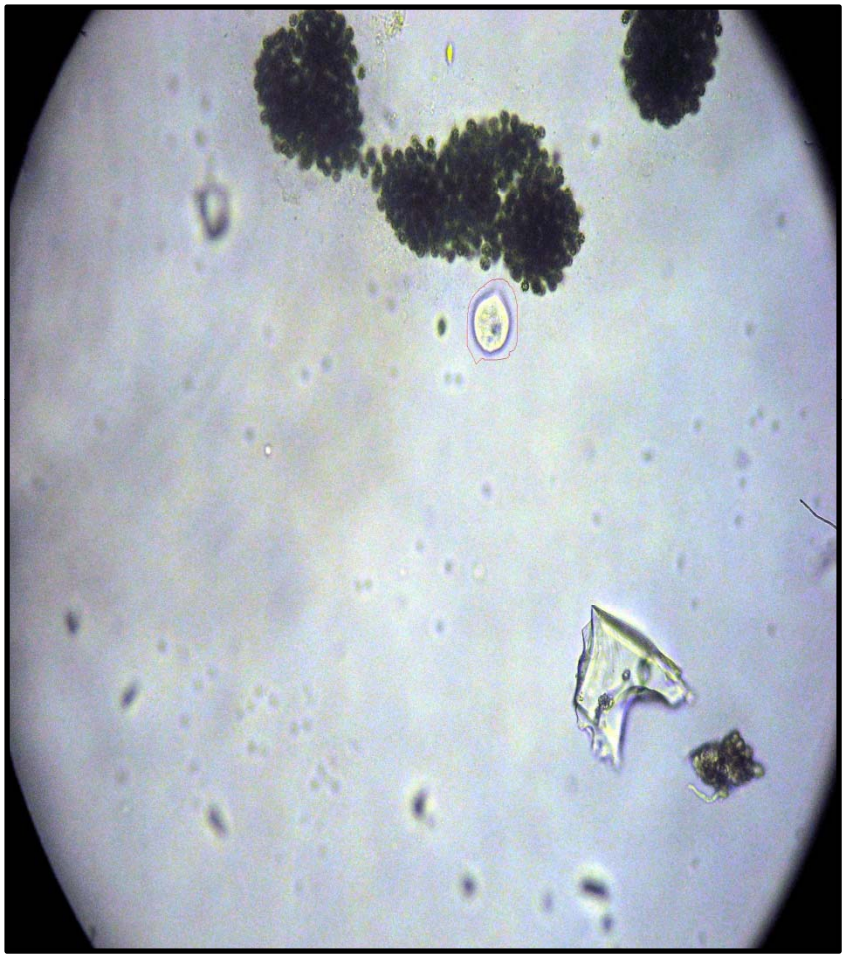
Euglena



Scenedesmus



Tintinidium



carteria

- As for the fish yield, it is quoted from FAO (Food and Agricultural Organization) that Morpho-Edaphic Index (MEI) which is an indicator of productivity of the lake system towards an optimum level for aquatic fauna should be between 50 – 200. Our measurement index in Malathalli Lake between 2006-07 was at an average 66.02.

5.Engaging the Underlying Problems

- To protect the local watersheds and mitigate urban **waste water** and **solid waste issues**. As the city's pace for expansion continues to overtake the master planner's guide to urban environmental management and controls, **there is little to chance that a scientist alone can do beyond what has already been published and recommended in peer reviewed journals.**
- Evidently, the quest for ecological restoration of the urban lakes has raised a **conflict among scientists, agency personnel, policy makers, and conservation planners**, whose respective urgent needs deviate away from the ecological consensus needed for wetland restoration.
- **The core of the matter in this case is the never-ending debate about the connectivity between wetlands and the surrounding landscape. Therfore it is must to protect landscape, catchment area and nalas which are still better in some series of Bangalore urban.**

The Kengeri Series Meso-Watershed

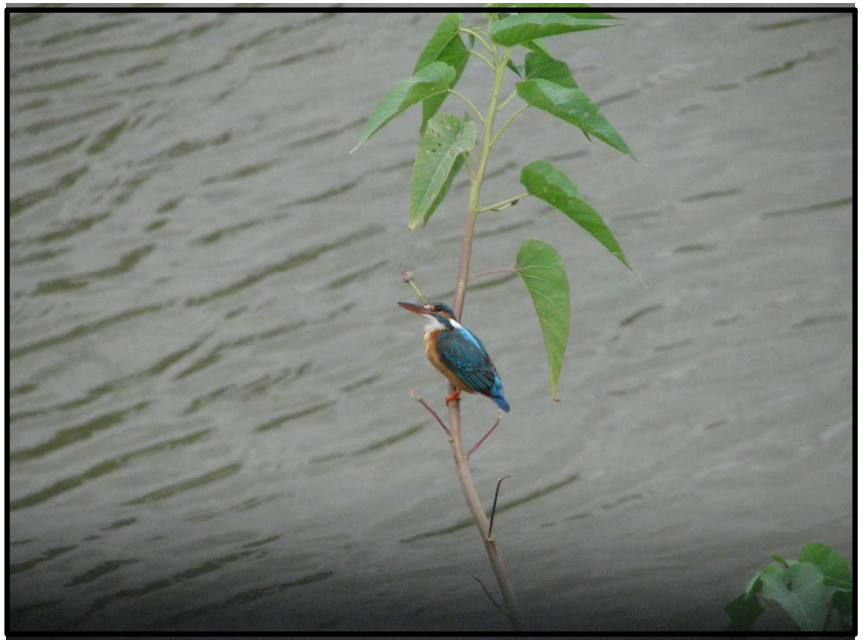
The Uppermost Catchment at Kannahalli

Human Ecology is affecting the top catchment

Kannahalli in 2009

The Southern Outlet

Kingfisher at Kannahalli Lake



Kanchanapura 2008

The Dry Lake Bed

Transmission line on a dry bed

Kanchanapura Lake in 2009

Degraded Basin in 2009

Remnants of Biodiversity

Ramasandra

Degraded shoreline

From the Bund Road

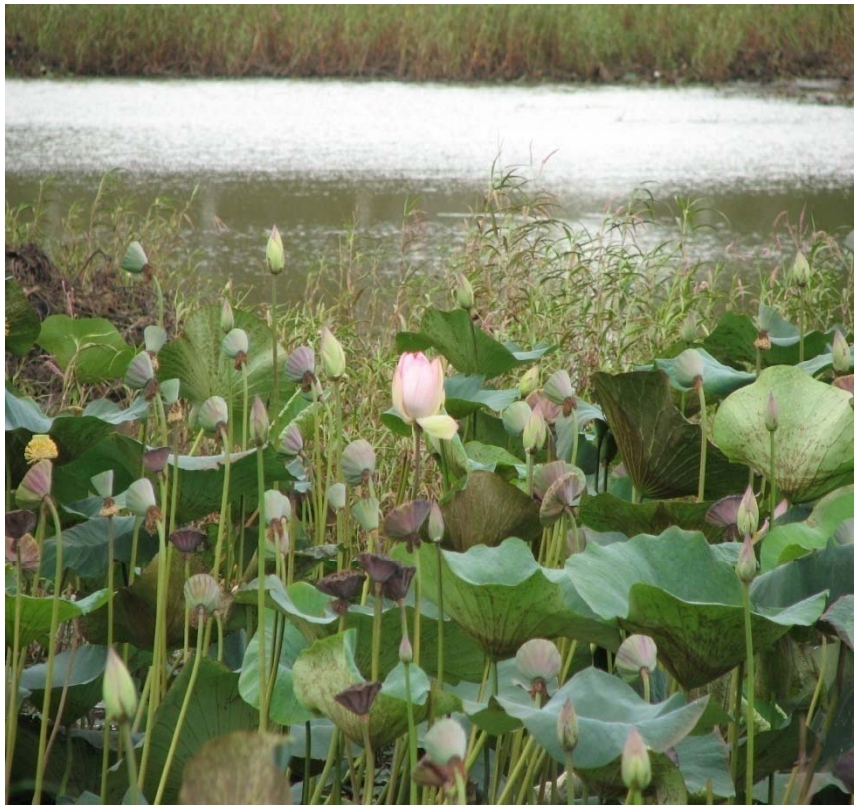
Komaghatta

Sub-Series on NICE Road

Sub-Series on NICE Road

Ketohalli in 2008

Lotus in Ketohalli Lake



Pockets of water holes

Bimakuppe

Degraded Basin

Sand Mining Unabated

Byramangala

And they still fish in the lake!

..and graze their cattle!

Byramangala

We feed ours with toxic water

And the journey towards cauvery begins here

- It is for this reason that the current initiatives for sustainable rejuvenation are under similar threats and doomed to failure just like the two major restoration initiatives of the late 80s and early 90s of the Forest Division and those of late 90s and early 2000s which were undertaken multilaterally between the local and national agencies on one hand and the international agencies on the other. **Unless, the issue of the surrounding landscape is owned up and accepted as the principal attribute towards environmental conservation of wetlands**. For example- Kannahalli - Kanchanpura – Ramasandra - komagatta – ketohalli – Bimakuppa – Byramangala – towards cauvery.

- **Information failure** refers to the general lack of appreciation by the public of the full ecological and economic value of the urban wetlands.

- Instead of saving the wetlands, these intervention failures thus cause the lakes to suffer from both quality degradation induced by pollution and overexploitation because of their open-access nature

- **The absence of national integrated resource management policy** has also resulted in intervention failure, in the form of *inter-sectoral policy inconsistency* leading to wetland destruction/degradation. Different sectors tend to defend their own sectoral priorities.

- It is critical to stress here that **lake rejuvenation is not a one-time project for DPRs and ecological engineering (ILEC:2007)**. Management interventions are first done in isolation to salvage the lake basin from collapse and this is where agencies such as BDA, BBMP, LDA, Forest Department, etc take initiative. But this is only the first step and only then can a complex system of integrated lake management program comes in. Most lake restoration projects in Bangalore have been extensively done on the basis of a one-time project.

6.Strategies for Restoration

- There is a global approach in conservation and management of lakes and reservoirs around the world.
- This approach must enter the mainstream of the economic development process through comprehensive water resources management .
- Lakes and reservoirs are extremely important, therefore they must be managed as part of a larger ecosystem rather than as independent units.
- **Let it be known here that each lake organization plane will be unique**, because each lake is ecologically unique, therefore management that works on one type of lake may not work on another which is the fundamental logic.
- Being closed systems, lakes take hundreds of years to flush out contaminants and this problem is exacerbated by the fact that management of lakes, irrespective of their sizes, involved complex processes that are often seen as going contrary to the development or growth of a region attached to that water body system .

Continue…

Any environmental management plan involves specific goals intended for restoration and conservation of wetlands. These goals are as follows;

- Water resources planning throughout the watershed areas involves participation all the way to **community level**
- Improving the allocation of water resources with respect to **irrigation and urban water delivery**;
- Pollution prevention and abatement of pollution through controlling both point and non-point source pollution;

7.Components of Lake Restoration and Management

- There are 6 main components identified by International Lake Environment Committee (ILEC) that should be involved in protection of wetland: Institutions to manage the wetlands and basin resources for sustainable use .
- Institutions may be local councils, regional authorities, national agencies and even international organizations.
- Policies to govern people's use of wetland resources and their impacts.
- At the national level, they can be encoded in formal laws, statutes, and regulations and implemented by formal institutions. At the local level, policies are implemented through rules of behavior, incentives, and education to change people's behavior.

- **Involvement of people** is central to wetlands basin management. People can provide knowledge about lakes in their local surroundings and also help in enforcing rules and accountability. Moreover, people can also be a source of financial support in conservation and maintenance of wetlands basins.

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- Investment in better technologies such as ecological engineering and sewage treatment is essential in providing solutions to some of the major problems affecting wetlands;
- **Information on and harnessing of both scientific and traditional knowledge** promotes efficient management of a **wetland basin and the surrounding areas**.
- Financial support and financial resources in wetlands management.

When formulating policies towards Wetlands Management Programs; the following is required:

- The resource conservation and management of environment needs a holistic approach involving strong cooperation of the people in the **participatory** programmes.
- The management programs should adopt economically sound measures that act as incentives for conservation and sustainable use of resources and components of biodiversity of these fragile habitats.

Continue…

- Promoting scientific, technical and socio-economic co-operation with the stakeholders, and implementing measures that avoid and minimize adverse impacts on wetland biodiversity should be encouraged;

- Integrated management with a collaborative approach, which brings together interested parties to incorporate social, cultural, environmental and economic values, needs to be looked into.;

- Socio-economic assessment for conservation, social, cultural, and economic activities is an essential component in the development of integrated management plans.